**`HANOI UNIVERSITY OF SCIENCE AND TECHNOLOGY**

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**FEASIBILITY STUDY**

**Introduction to Software Engineering**

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**RISK ASSESSMENT FROM CAR’S DASH CAM**

1. **EXECUTIVE SUMMARY**

The following system is recommended for motorists. The customer representative is Ph.D. Trinh Thanh Trung. Mr. Trung made suggestions and requests from customers and project participants. Mr. Trung will also be the main customer and will directly discuss system-related issues with us. The basic goal of the development team is to deploy a system combined with dash cams to detect objects appearing in the frame to give environmental warnings via speech or display on screen. The new system can allow multiple people to use the system at the same time, then record data into a centralized database, users can extract information from the database. In addition, the system also provides reports according to a certain time (by day, by month, by quarter, by year). The overall goal of the system is to assist the driver to make the safest decisions in traffic, reducing the need for observation and judgment in all cases. The successful implementation of the system can partially support the driver when participating in traffic, besides, it can also integrate the system to develop a very promising autonomous driving technology in the future.

**II. PRELIMINARY REQUIREMENTS ANALYSIS**

**Part 1: Application Overview**

**Objective**

The basic function of the system is to collect image data from dash cameras in real-time and assess the danger level of traffic situations through these images, then provide warnings to the driver. Additionally, the system will store the assessment data in a central database. Queries can be made to generate user behavior reports for relevant parties, such as police, insurance companies, etc.

**Business Objective**

The project aims to increase traffic safety. The product helps reduce traffic accidents and improve safety for drivers, passengers, and pedestrians by providing timely alerts and assistance for the driver to react accordingly. Moreover, this system also supports the development of new products and services: leveraging AI and dash cameras to create new products and services such as safety monitoring systems for transportation businesses, intelligent parking assistance, or behavior-based insurance. Furthermore, the system can help optimize costs for transportation businesses by reducing traffic accidents, improving operational efficiency, and minimizing insurance costs.

Through this traffic situation warning and assessment system, the management team hopes to improve drivers' decision-making while driving, consequently reducing traffic accidents and saving transportation costs. The project also aims to provide various benefits for related parties such as police or insurance companies in assessing drivers' behavior. A functioning prototype will be developed, tested, and deployed in a timely manner for practical implementation in the next semester (Fall 2023).

**Current Business Process**

Currently, danger warning systems in cars mostly rely on hardware sensors, and these systems have relatively "rigid" warning levels. For example, rear proximity sensors will trigger alarms for any object appearing within the sensor range, regardless of whether it is a floating balloon or a teddy bear, even though they pose no danger to the driver. Some more advanced systems are only equipped on luxury vehicles costing from one to several billion.

The new system hopes to provide a flexible, comprehensive, and cost-effective warning solution for drivers. In addition, it will create a centralized database of traffic situations for analysis and use by relevant parties. For instance, safety monitoring systems for transportation businesses, intelligent parking assistance, or behavior-based insurance, thereby increasing business opportunities and revenue.

**Roles and Responsibilities of Users**

Administrator Role: Install and integrate the AI system with dash cameras, as well as other auxiliary systems in the vehicle. Ensure the AI system is always updated and functioning stably. Create and manage user accounts, assign access permissions to members within the organization. Set up and configure danger alert notifications for drivers. Ensure data security and compliance with privacy regulations. Analyze data collected from the AI system to propose improvements to traffic safety.

Driver Role: Comply with instructions and warnings from the AI system. Maintain and periodically inspect the vehicle to ensure the AI system functions well. Report incidents and issues related to the AI system. Cooperate and share information with administrators to improve the system.

Maintenance and Technical Staff Role: Assist administrators in installing, configuring, and upgrading the AI system. Inspect, repair, and maintain the AI system, ensuring stable operation. Support drivers in using and troubleshooting issues related to the AI system.

Data Analysts and Researchers Role: Analyze data collected from the AI system to assess traffic safety effectiveness. Propose improvements to the AI system based on analysis results. Research and develop new AI solutions to enhance traffic safety.

**Interaction with Other Systems**

Public Traffic Data System: The AI system can connect to traffic management agencies, sharing data on dangerous traffic situations, helping these agencies understand traffic conditions and implement accident prevention solutions.

**Considerations for Production Deployment**

Before deploying the system into production, thorough testing and inspection should be conducted to ensure the system's performance, accuracy, and reliability. Additionally, the system should be designed to be user-friendly, compatible with various dash cameras, and suitable for different vehicles. Users will be trained to master the system's usage, understand its features, and know how to handle potential issues.

**Part II: Functional Requirements**

**Functional Statement**

Users should be able to view the activities of a station or dash camera on a specific day, helping to monitor traffic conditions and evaluate safety effectiveness. The system must accommodate simultaneous access requests from multiple users (approximately 200 drivers) on different computer stations. The system should allow data classification according to criteria such as name, time, location, danger level, etc. The system must be capable of generating specific reports tailored to users' needs, helping them assess traffic safety effectiveness and implement improvement solutions. The system should integrate automatic data backup from a central data warehouse, ensuring data security and restoration when necessary. In addition, users' access rights should be protected by passwords to prevent unauthorized access.

**Security and User Capabilities**

The system supports at least three types of users, including administrators, regular users, and guests. Each user type will have different access rights and functions within the system. Administrative-level users will have the authority to manage user accounts, add or change employee levels, and user types. They also have the ability to restrict changes to categories on input forms. Drivers: Users at this level only have data entry privileges in the system. They do not have access to administrative functions and system configuration changes. Guests: Users not logged into the system can view public information and search within the system but have no data entry or editing rights.

**Reporting**

Daily, weekly, monthly, quarterly, and annual reports will be generated based on reference data collected and stored in the central data warehouse. Additionally, there will be danger level reports: This report will analyze traffic situations based on danger levels, helping to identify high-risk areas and times for implementing traffic safety improvement measures. System performance reports: This report evaluates the flexibility, sustainability, ease of use, and effectiveness of the system, helping managers assess and improve the system over time. The success of the system will be measured by assessing its ability to meet requirements, including simultaneous access from different stations, central data warehouse design, automatic backup, data recovery, multiple user access levels, etc. It is estimated that after one week of training and testing, users will be able to use the system effectively. Ease of use and system effectiveness will be important performance metrics.

**Optional Features**

Export data as CSV: The system is capable of exporting data as CSV (Comma-Separated Values) files, allowing users to easily import data into spreadsheet applications such as Microsoft Excel or Google Sheets for flexible data analysis and processing. Integration of advanced search tools: The system integrates advanced search tools, enabling users to search for information based on various criteria, such as keywords, time range, data type, etc. This feature helps users save time and improve work efficiency. Notifications and alerts: The system provides automatic notification and alert functions, helping users to promptly capture important events or changes in statistical data.

Usability Operating speed and user interface, collection and storage of important quantitative data, automation and concurrency, training support and user guidance are important considerations.

**Scope**

The scope of our system includes creating table reports, managing users, backing up and restoring data, editing and supplementing information, etc. However, the system will not have significant changes to the basic information collection method. The system will not support major changes to the basic information collection method, maintaining the current data entry and management processes.

**III. PROCESS TO BE FOLLOWED**

For this project, the development model that our team decides to follow is a modified waterfall, which includes:

Define requirements

System and program design

Write programs and tests

Accepted and marketed

Commissioning and maintenance

The test and maintenance phase are at the core of this model as it allows the software development team to make changes to any stage of the development model without affecting the progress of the project. This is because the software needs to be fine-tuned to adjust to changing circumstances or customer needs. The requirements were clearly stated and the design of the user interface, the administration system and the interface for the system administrator were basic and not overly complicated, that's why the team chose the development technique. This. The team was able to improve the modified waterfall method by leveraging feedback from the software testing customer team. However, this model only performs refinement when all previous stages have been completed and each tweak from a given previous stage has a different impact on the project. That new design requires a rewrite of the program not only the interface but also the important program related to the system, and both the design phase and the writing phase need to be fine-tuned. again. As a result, each adjustment might cost a lot of money and effort, thus the team must carefully consider each adjustment before making it.

Below are the milestones across the project and the requirements that the software development team must complete in each phase.

**Requirements Document**

The team will prepare a formal document detailing the potential customers' requirements for the software. The customer will categorize these requirements into required, desired features. Based on those requirements, the team will consider and decide what features the software will include that can best meet the needs of the customer market that the team is targeting.

**Design Document**

The team will prepare a formal document detailing the design of the software:

System architecture design: Provides an overview of how the system works, including components, data types, information flows, and communication between those components.

Detailed design: Present the specific details of the components in the system such as features, properties, implementation.

Design user interface, admin interface: The user interface needs to be clear, convenient for users, easy to tweak for future features. The administrator interface needs to have a very comprehensive view of the system, for each component must have a very clear and detailed view, so that the new system management can be strictly implemented.

**Acceptance Testing Document**

The team will prepare a formal document detailing the test results of the software after the system and programs have been built. It includes detailed information about testing methods, test results, software improvement suggestions and tested product versions. The test results detail the bugs and problems found in the software, helping the team more accurately understand the stability and correctness of the software so that they can make suggestions for improvements to the software. Finally, after making improvements, the team will release a tested version of the product that will be deployed to customers.

**Modified Documents**

This is a document that provides detailed information on the tweaks that can be made considered based on customer and market requirements for the current version of the software. The documentation includes the tweaking feature, a checklist of what to do for the tweak, an estimate of human and resource costs, and a risk assessment table for the new feature's interference with the current system.

**Final Document, Representation and System**

The team will prepare a formal document detailing the software after it has been refined according to the customer's improvement requirements on the previous version so that the final product can be put into operation and maintained. The document covers all features, including those that have been tweaked, including required software features and extended features. For the customer presentation, the team prepares a user-guided video for the user interface.

**IV. SUGGESTED DELIVERABLES**

**1. Periodic Status Reports**

Periodic progress reports are written and presented to the client to ensure transparency and efficiency in project management.

The main purpose of periodic reports is to provide information on the progress and performance of the project, helping customers to evaluate product development and adjust their business activities accordingly.

Periodic progress reports detail the activities carried out, the work remaining in the development plan, the risks and challenges in the product development process, and how the team Product development is addressing these issues depending on the stage of the development process:

Requirements: Communicate with customers to find out the requirements, then check the feasibility of the requirements and periodically report the test results to change the requirements accordingly.

Design: Periodically report the system design to the customer, the system's functions and efficiency to make appropriate changes.

Coding: Periodic reports on implementation progress and encountered errors help find the right solution

Testing: Talk to customers about test cases to be tested and perform tests, then report progress

Maintenance: Perform periodic testing of the program and ensure that user errors can be corrected and suggest and discuss features that need to be updated with customers and periodically report on the process.

**2. Periodic Presentations**

Periodic presentations will be made with periodic reports, helping to visualize and highlight important points in the periodic reports.

Periodic presentations will provide customers with an overview of the progress and performance of the project as well as the problems that the development team encounters, helping the project to be transparent. At the same time, we want to collect feedback and suggestions from customers to improve the direction and implementation of the project depending on the stage.

**3. Application**

The system includes an app for users deployed on the car system and will be linked to the dash cam. The system will work whenever the vehicle is in control. It will detect danger and notify the driver through sounds or through the terminal.

The user will need a password to access the system, then the user can generate a report for a certain period (a week, a journey, a quarter). The report contains information about danger detections and the time of the detections.

**4. Good Faith Requirements Agreement**   
After the project requirements have been discussed and reviewed with the client, a requirements agreement will be presented to the client to clarify exactly what the project is intended to achieve. The agreement will clearly state the features and goals the team intends to deliver

**5. Documentation for Use and Mechanics**

Customers will be provided with documentation that explains how to use our system and describes its basic mechanics. The customer has expressed an interest in becoming familiar with the system and the documentation will be useful for reference needs.

**6. Demonstration and Client Training**

Besides the documents, the clients need to train the drivers to use the systems. The team will meet this need by providing demonstrations of the system and by allocating time after the final system is completed to train customers on how to use our system. will include performing routine tasks defined by the client and training will include group instruction led by team members or one-on-one training with the client.

**V. TECHNICAL FEASIBILITY**

The team will present the feasibility of the technical solutions to meet the client's needs. As any technical solution must demonstrate the client's requirements, identifying the feasibility of the techniques is crucial. The feasibility of technical requirements can be assessed by determining and outlining at least one technical method that will meet the client's needs.

Technical requirements

1/ Data sorting by different fields (time, date, label)

The time, location, and type of alert will be recorded for the purpose of extraction or statistical analysis if necessary.

2/ Centralized data repository

Each vehicle will be equipped with an alert software, and data regarding the time, location, and type of alert will be recorded and stored in a centralized data repository.

3/ Multiple levels of access to system:

For users, they have the right to add and extract alert the system's alert history.

4/Administrative interface

A system administrator with the authority to modify and change the software is required, who can add features and types of alerts to improve the performance of the software.

5/Create automated reports

The system will automatically compile reports and send them back to users on a weekly/monthly basis or during specific timeframes and on routes that frequently have one type of recurring alert.

6/ Object detection and Automatic alerting

The system will alert users by using AI models to analyze videos recorded by dash cams and then display alerts on the screen or provide voice alerts.

7/ Turn on/off alert:

Regarding enabling the alert system: when the vehicle starts, the system will be automatically turned on.

Regarding disabling the alerts: Users can turn off the alerts if they have already perceived the danger, or if the alerts are easily noticeable, the driver can also turn them off permanently.

8/ Security

Security needs to be maintained to ensure the integrity of the data, even though harmful or beneficial modifications are not expected. Password protection and login systems (based on access levels or user types) are sufficient for protection.

9/ Multiple simultaneous users:

Multiple users can operate simultaneously, and all data regarding the time, location, and type of alert for each user can be recorded in the centralized data repository.

**VI. VISIBILITY**

The team will strive to maximize driver recognition and alerts, ensuring client requirements are met. Any technical issues can be detected through testing.

**1. Communication**

Direct meetings and emails will be the main communication methods to update the customer on the project's progress. Regular meetings will be organized with the customer to discuss progress and facilitate two-way feedback. The team will also have a weekly all-hands meeting to ensure that all members understand their roles and tasks.

**2. Intermediate Deliverables and Presentations**

Live demonstrations: The project progress will be presented to the customer through live demonstrations, which will be held at the customer's site and at monthly presentations corresponding to each major phase of the project.

Presentations: A presentation showcasing the layout design of screens, reports, and a demo of working features and systems will be displayed to the client for progress updates by the team.

Reports: The clients will also be provided with copies of documentation that detail the specifics of each phase in the software development process. These progress reports will also allow them to gain a clear understanding of project details from their perspective.

**VII. RISK ANALYSIS**

**1. Risk of time**

Since the course requirements state that the project must be completed within one semester, no extension can be undertaken. This leads to the risk that the system may not be completed with the full functionality required by the customer within a certain timeframe of a semester. If the customer chooses to wait until the system is fully completed, it may result in a delayed system deployment.

**2. Resource risk**

The image quality obtained from the dash cam can affect the system because if the resolution is not guaranteed, it will cause errors in object detection and lead to inaccurate warnings.

For now, to keep costs to a minimum, the team is looking at free, open-source software. The hardware for actual system implementation also depends on the hardware available to the computer. During system operation, resource-based risks include hardware failure, system crash, failure in code, etc., can cause accidental data loss.

**3. Functional risk**

We can deal with some risk as below:

Wrong object detection leads to false alarms that have potential consequences when influencing driver decision making.

The slow warning speed leads to the driver not being supported in time to make decisions when participating in traffic.

The warning is suspended, cannot be turned off, causing distraction and affecting the driver's concentration when participating in traffic.

The system records incorrect data resulting in fruitless searches and false reports.

The search process does not produce the desired results due to algorithm errors or displays wrong results.

The interface is not simple enough for users to use, the training process does not help customers understand the system's features.

**4. Risk Management/ Mitigation**

To be able to prevent and reduce the risk caused by the above risks, the team intends to divide the project into milestones equivalent to the stages as described in the Process section. At each milestone, the team will research and clarify the possible risks at each step. The team will also talk to the customer, giving a report at each milestone to clarify the customer's wishes and help the customer get familiar with the system.

**VIII. Commitment and terms**

**1. Protect transactions and sensitive information.**

To the extent that the team can gather from the dash cams of the cars, no trade secrets or sensitive information will be handled during the implementation of our system. Since the information is only related to the images/videos of the road and considering the danger level of each frame, information that is not sensitive in nature will have to be strictly protected through a number of security measures. Even in this case, the system will be designed with password protected pages to prevent bad guys from being able to access and corrupt this precious data.

**2. Copyrights and Trademarks.**

The group will issue a limited license to Polytechnic University, Mr. Trinh Thanh Trung and related automobile companies, hereinafter referred to as “customers”. This limited license will entitle the customer to use the software system for an unlimited period of time. The team will not be responsible for any modifications after the software system is delivered but will help answer any questions or concerns from the customer as time and circumstances permit. The authorized group can demo the software system for potential employers and present the software system as a work created by each team member. Since the group has no plans to trademark any names associated with the software system, the trademark should not be considered an issue.

**IX. CONCLUSION**

From the results of the feasibility study, the team found that the project risk assessment from the car's dash cam is feasible in terms of technicality, team members' skills, and time. With a time, limit of one semester, the team believes that the scope of the project is manageable and that the customer requirements can be satisfactorily met upon completion of the system. Team members are also skilled enough to implement the system and are familiar with the hardware and software that may be used in this project. The conclusion of the feasibility report is to continue with this software development project.